

Module 10 Lesson Plan

Strategies for Negotiating Hills and Curves



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M10—Strategies for Negotiating Hills and Curves



Lesson Objective: The student applies time and space management strategies and demonstrates vision skills to recognize line of sight and/or path of travel restrictions encountered on hills and curves; demonstrates reduced risk speed and lane position adjustments for approaching, entering, apexing, and exiting a curve; demonstrates speed control when ascending and descending hills; demonstrates stopping and starting on a hill; and explains conditions that could affect traction while traveling through a curve.

| Instructional Topic | Content | Slide |
|------------------------|---|--|
| DRIVING THROUGH CURVES | <p>Introduce, model, practice and discuss Curves come in a variety of designs</p> | T10-1 |
| | <p>Miscalculating the radius of a curve and entering a curve at an unsafe speed is a driver behavior that leads to many single and multiple vehicle crashes</p> <p>Curves have a higher risk because there can be many restrictions to the line of sight and/or path of travel, such as</p> <ul style="list-style-type: none"> • Trees • Buildings • Hills <p>Even after driving a road hundreds of times, conditions such as weather, animals, or your vehicle can produce new and unexpected challenges unless the driver maintains awareness of the road conditions</p> | T10-2 |
| TYPES OF CURVES | <p>Introduce, model, practice and discuss One way to describe a curve is by its radius—it follows the circumference of one or more circles</p> <ul style="list-style-type: none"> • The larger the radius, the easier it is to drive through • The sharper the curve, the smaller the radius, slower speed is needed <p><u>Examples of different curves:</u></p> <ul style="list-style-type: none"> • Constant radius curve follows the circumference of just one circle, and have less surprises • Downhill curves are where vehicles will naturally pick up speed • Decreasing radius curves is where the curve gets progressively tighter requiring more steering wheel adjustments • Increasing radius curve is where the curve is sharper when you enter it and less sharp at the exit • Blind curves is where only a portion of the corner is visible, the rest of it is hidden by trees, hills, crops, or buildings • S-Curve is a curve in one direction with a second curve in the opposite direction, making the shape like an “S” | <p>T10-3</p> <p>T10-4</p> <p>T10-5</p> |

Student Learning Activities

Resources




**Hills and Curves
Strategies for Negotiating**





Montana Driver Education and Training

DRIVING THROUGH CURVES


Curves Come in a Variety of Designs

Curves have a higher risk because there are many line-of-sight restriction and/or path-of-travel restrictions such as:

- Trees
- Buildings
- Hills






TYPES OF CURVES



Constant Radius

- Follows the circumference of one or more circles
- Line-of-sight less restricted

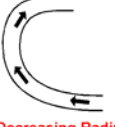



Uphill/Downhill

- Uphill: acceleration is needed to maintain speed
- Downhill: vehicles will naturally pick up speed


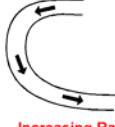
M 10

TYPES OF CURVES



Decreasing Radius


- Curve gets tighter requiring more steering adjustments

Increasing Radius



- Curve is sharper when you enter it and less sharp at the exit

TYPES OF CURVES



Blind Curve

- Only a portion of the corner is visible, the rest is hidden

S-Curve

- A curve in one direction with a second curve in the opposite direction, making the shape like an "S"

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Student Learning Activities

Resources



TYPES OF CURVES



Winding Road
• A series of curves



Banked Curve

- One side of the curve is higher than the other side to help vehicles through the curve such as freeway entrances
- Some curves have negative banking that can create less traction

M10.6

SEARCHING FOR CURVES

Search Far Ahead

- Searching far ahead is good; seeing the end of the curve is better
- If the target range shows trees, bushes, and grass – there's a curve

When approaching a curve, ask:

- Does the roadway curve left or right?
- Can the exit be seen?
- How sharp is the curve?
- What is the lane width, shoulder conditions, posted speed, advisory speed, and traffic volume?
- What other questions should be asked?



M10.7

M 10

SEARCHING FOR CURVES

After seeing a curve:

- Check the rear zone
- Check left, front, and right zones
- Search into the curve and evaluate the path of travel before turning the steering wheel
- Search for traction conditions
- Determine the best speed



Photos courtesy of AAAA Foundation



M10.8

FORCES AT WORK IN CURVES

Student Learning Activities

Resources



Signs and Markings

Interpret warning signs

- Know their meaning



M10-8

The Apex

The Apex is about the **middle of the curve**, closest to the inside edge of the turn

- Select a path of travel that will help "straighten out" the curve — use the Apex as a tool to help select a safe path of travel through a turn



M10-10

M 10

The Apex

When searching, evaluate the condition of the Apex to determine the best lane position at the Apex

- Identify road surface and traction conditions
- Mountain roads often have rocks and boulders that could affect path of travel in the Apex
- Identify other drivers and their path of travel



M10-11

FORCES AT WORK IN CURVES

Vehicle Weight Transfer

- **Curves can be dangerous places**

- Centrifugal force must be overcome as it pulls the vehicle to the outside of the path
- Higher speeds create more pulling force that must be overcome
- Excessive speed in curves is the cause of many crashes as drivers are often unable to maintain their path of travel



M10-12

| Instructional Topic | Content | Slide |
|--|--|--------|
| <p>◆ Vehicle Weight Transfer (Cont.)</p> | <ul style="list-style-type: none"> Braking, acceleration, and turning forces consumes traction ... Use too much of any one of these forces and traction can exceed the vehicle's tires capability – resulting in loss of control <p>Imagine there is a vertical line through the steering wheel at 12 and 6 o'clock</p> <ul style="list-style-type: none"> The left-hand stays on the left side of the wheel and the right hand stays on the right side Use push/pull steering, keeping the steering actions smooth and controlled Keep both hands on the steering wheel <p>The higher the speed, the greater the forces will be on a vehicle going through a turn</p> <ul style="list-style-type: none"> Speed can be the enemy in a curve—when in doubt, slow down <p>If the braking action is hard, the down force caused by braking will transfer weight to the front tires</p> <ul style="list-style-type: none"> The force can exceed the tires' traction limits and skid <p>If a turning action is too sharp, the yaw force can result in the back tires skidding</p> <ul style="list-style-type: none"> If a turning action is excessive and causes the driver to react by turning sharply back, roll forces can result in a rollover Turns should be made as smoothly as possible, without jerking the steering wheel | T10-13 |
| <p>—A True Story</p> | <p>Johnathan would have been 19 on his birthday. He had so many years of life ahead of him. But Johnathan died early one morning in a motor vehicle crash, one of hundreds of crashes that take place every day in America. Like so many young drivers, he had very little experience with the complexities of driving. When he turned the steering wheel too much around a curve, he panicked and yanked the wheel the other way, forcing his half-ton truck into a rollover. He and the two young men in the truck with him were ejected from the vehicle and sustained serious injuries. Johnathan died three days later—and so did the potential good this bright, hopeful young man may have done during his time on earth.</p> | |

Student Learning Activities

Resources



FORCES AT WORK IN CURVES

Vehicle Weight Transfer (Cont.)

- As a vehicle travels through a curve, inertia works on the vehicle along with pitch, roll, and yaw
- The goal is to keep the vehicle in controllable balance throughout the curve
- Smooth, controlled steering is needed



M10-13

M 10

| Instructional Topic | Content | Slide |
|---|---|--------|
| FOUR STEPS FOR DRIVING THROUGH CURVES | <p>Introduce, model, practice and discuss</p> <p>How well a vehicle performs in curves will depend upon the vehicle's speed, the vehicle's weight, the sharpness of the turn, pavement condition, and the driver's skill</p> <p>Good cornering techniques combine braking, steering, acceleration, and visual skills</p> <ul style="list-style-type: none"> • The goal is to reduce the amount or suddenness of braking, accelerating, or steering efforts • Speed, the sharpness and bank of a curve, and the vehicle's load, affect vehicle control • It is important to read the curve to determine the type of curve and conditions | T10-14 |
| 1. Approaching Curves | <p>When approaching a curve, select the best lane position to help straighten out the curve as much as possible while keeping a good separation from oncoming traffic and undesirable conditions along side the road</p> <ul style="list-style-type: none"> • Check your rear zone and front zones to decide the best options • Selecting the best lane position will set up a path of travel requiring the least amount of turning of the steering wheel • When approaching a curve, if speed reduction is needed, use <u>controlled braking</u> before reaching the curve • Avoid the need to brake hard while in a curve, by reducing speed before the curve | T10-15 |
| 2. Turn the Head and Look Through the Curve | <p>Before turning the steering wheel, turn the head and look all the way through the curve as far as possible to the exit of the curve</p> <ul style="list-style-type: none"> • Determine which steering technique is best: push/pull or hand-over-hand | T10-16 |
| —See the Exit | <p>If the exit of the curve can't be seen, evaluate speed</p> <ul style="list-style-type: none"> • Evaluate the new target area as soon as the exit is seen • Search road, traffic, and environmental conditions that could restrict LOS | |
| 3. Speed Control | <p>Remember the goal is to maintain vehicle balance and traction control when entering and driving through curves</p> <ul style="list-style-type: none"> • Use speed control techniques to maintain vehicle balance and traction control when entering and driving through curves | T10-17 |
| | <ul style="list-style-type: none"> • The radius of the curve will determine the safest speed ... The sharper the curve, the smaller the radius, the slower the speed must be | T10-18 |

Student Learning Activities

Resources



FOUR STEPS FOR DRIVING THROUGH CURVES

Good cornering techniques combine braking, steering, acceleration, steering, and visual skills:

- Reduce the amount of sudden braking, acceleration or steering
- Read the curve to determine the type and condition of the curve
- Be aware of effects of vehicle load and driver control



How well a vehicle performs in curves depends upon:

- Speed and weight
- The sharpness of the turn
- The pavement condition
- The driver's skill



M10-14

FOUR STEPS FOR DRIVING THROUGH CURVES

1. When Approaching Curves

- Select a lane position that will help straighten out the curve while keeping a good separation from oncoming traffic and roadside conditions



- Check front and rear zones
- Select the best lane position requiring the least amount of steering
- Reduce speed (if needed) before the turn with controlled braking
- Avoid hard braking while in a curve

M10-15

FOUR STEPS FOR DRIVING THROUGH CURVES

2. Turn the Head and Look Through the Curve

- Use visual control by turning the head and looking all the way through the curve as far as possible to the exit of the curve
- If the exit is not visible, evaluate speed – is a lower speed needed?
- Evaluate the new target area



Determine which steering technique is best: push/pull or hand-over-hand?

M10-16

FOUR STEPS FOR DRIVING THROUGH CURVES

3. Speed Control

- **Going downhill:** Downshift to a lower gear and let the transmission help control speed
- **Going uphill:** Accelerate to maintain speed



Describe the front zone conditions in this San Diego street scene.

M10-17

FOUR STEPS FOR DRIVING THROUGH CURVES

3. Speed Control (Cont.)

- **Controlled Braking:**
 - Used prior to the curve
- **Threshold Braking:**
 - Used when maximum braking force is needed prior to the curve (What was insufficient if hard braking was needed?)
- **Trail Braking:**
 - Used when braking is carried into the curve, trail brake to the apex to maintain steering control
- **Acceleration:**
 - Begins when about halfway through the curve or when the exit can be seen



M10-18

M 10

| Instructional Topic | Content | Slide |
|----------------------------|--|----------------|
| 3. Speed Control (Cont.) | <ul style="list-style-type: none"> If the curve is on a hill <ul style="list-style-type: none"> ... for downhill, downshift and let the vehicle's transmission help control speed ... for uphill, acceleration may be needed to maintain speed | T11-18 (cont.) |
| —Controlled Braking | Use controlled braking if a reduction in speed is needed prior to the curve | |
| —Threshold Braking | <p>Threshold braking is maximum braking force and should only be used when a vehicle is going straight</p> <ul style="list-style-type: none"> ... If maximum braking is necessary, prior to the curve, the visual search was insufficient, or too late, to use controlled braking | |
| —Trail Braking to The Apex | <p>If braking was carried into the curve, trail brake to the apex, or until the exit of the turn and the new target can be seen</p> <ul style="list-style-type: none"> Trail braking will keep the weight over the front tires, giving steering control | |
| —Accelerate | <ul style="list-style-type: none"> Accelerate when about one-half way through the turn, at the apex <ul style="list-style-type: none"> ... In a blind curve, you may need to wait for acceleration when the exit can be seen | |
| 4. Lane Positions | If there is oncoming traffic, create as much separation from the oncoming traffic as possible | T10-19 |
| —Left Curve | <p>On narrow rural roadways with limited traffic and limited visibility, curves to the left present special problems</p> <ul style="list-style-type: none"> Oncoming drivers are more likely to drive over the centerline because inertia keeps that vehicle going in a straight line—directly into the other lane For a left curve, enter the curve in LP3 to get the best line of sight through the curve <ul style="list-style-type: none"> ... If the right front zone is closed, use LP1 At the apex, take LP1 for separation from oncoming traffic and best line of sight <ul style="list-style-type: none"> ... Exit the turn in LP1 | T10-20 |
| —Right Curve | <ul style="list-style-type: none"> For a right curve, enter the curve in LP2 for the best line of sight and maximize the probability of being seen by the oncoming driver <ul style="list-style-type: none"> ... Be aware of inertia forces that will want to keep the vehicle going straight, right into the oncoming traffic | |

Student Learning Activities

Resources



FOUR STEPS FOR DRIVING THROUGH CURVES

3. Speed Control (Cont.)

- **Controlled Braking:**
 - Used prior to the curve
- **Threshold Braking:**
 - Used when maximum braking force is needed prior to the curve (What was insufficient if hard braking was needed?)
- **Trail Braking:**
 - Used when braking is carried into the curve, trail brake to the apex to maintain steering control
- **Acceleration:**
 - Begins when about halfway through the curve or when the exit can be seen



M10-18

FOUR STEPS FOR DRIVING THROUGH CURVES

4. Lane Positions

Lane selection for entering, driving through, and exiting is important for maintaining vehicle balance and control

- **Oncoming Traffic:**
 - Create as much separation as possible
- **Left Curve:**
 - On narrow rural roads, left curves create special problems; oncoming drivers may go over the centerline as a result of inattention or inertia
 - Enter in LP3 for the best LOS
 - If the right front zone is closed, use LP1
 - At the Apex, take LP1 for separation from oncoming traffic and exit in LP1



M10-19

FOUR STEPS FOR DRIVING THROUGH CURVES

4. Lane Positions (Cont.)

- **Right Curve:**
 - Enter the curve in LP2 for the best LOS and increasing visibility to oncoming drivers
 - Be aware of the inertia forces that must be overcome
 - At the Apex take LP3 if the right front zone is open; take LP1 if the zone is closed (rocks, debris, etc.)
- **Exiting the Curve:**
 - Select the best lane and speed
 - LP1 is used when ideal conditions exist
 - Evaluate the new target area



M10-20

M 10

| Instructional Topic | Content | Slide |
|--|---|--------|
| <p>—Right Turn (Cont.)</p> <p>—Exiting the Curve</p> | <p>At the apex, be in LP3 with an open right front zone, LP1 if the right zone is closed due to rocks, etc.</p> <ul style="list-style-type: none"> Select the best lane position and speed <ul style="list-style-type: none"> ... LP1 lane positions is when ideal conditions exist—always adjust for traffic, visibility, and road condition as needed ... Establish the new target area and evaluate the condition of the LOS-POT | |
| <p>HILLS AND MOUNTAINS</p> | <p>Introduce, model, practice and discuss A hill can rise and descend gently or be part of a mountain range</p> <ul style="list-style-type: none"> Gravity is every driver's passenger when traveling up and down hills | T10-21 |
| <p>◆ Characteristics</p> | <ul style="list-style-type: none"> Montana has over 50 mountain ranges with many more areas of rolling hills <ul style="list-style-type: none"> ... To travel the state, mountain driving will be necessary <p>The Rockies are the most impressive mountain range in the United States</p> <p>In Montana, they pass through Glacier National Park on the north side of the state and Yellowstone National Park on the south. The Lewis and Clark Expedition crossed the Rockies in 1805 going west to the Pacific and in 1806 on their return.</p> <p>Mountain roads are often more narrow and lack guard rails or other barricades to separate traffic moving in opposite directions, or help protect against running off the road</p> <ul style="list-style-type: none"> There is less room for errors Drifting into oncoming traffic could result in a collision Drifting off the side of the road could result in driving off a cliff | T10-22 |
| <p>—Switchbacks</p> | <p>Mountain roads can have "hairpin" turns as they switch back and forth through the mountain</p> <ul style="list-style-type: none"> Turns are sharp as direction is reversed <ul style="list-style-type: none"> ... Describe some areas where these switchbacks occur ... These areas can be very dangerous, especially if used by trucks or buses Trucks and buses limit the line of sight, and may require more space on the "switchback" to complete the curve | T10-23 |

Student Learning Activities

Resources



HILLS AND MOUNTAINS

Characteristics

Montana has over 50 mountain ranges and many areas of rolling hills



- A hill can rise and descend gently or, can be part of a mountain range
- Gravity is every driver's passenger when traveling up and down hills



Photo courtesy of AAA Transportation

M10-21

M 10

HILLS AND MOUNTAINS

Characteristics (Cont.)



Avalanche Gulch

- **Switchbacks:**
 - Hairpin turns switch back and forth
 - Trucks and buses can obstruct the LOS and may need space to complete the curve



Photo courtesy of AAA Transportation

M10-22

HILLS AND MOUNTAINS

Characteristics (Cont.)

- **Slow Moving Traffic**
 - For slow moving traffic some areas have pull-out places about 2,000 feet long, allowing faster moving traffic the opportunity to pass safely
 - If more than four vehicles are being held up by a slow moving vehicle, Montana law requires pulling over to allow faster moving traffic to go ahead



Photo courtesy of AAA Transportation

M10-23

| Instructional Topic | Content | Slide |
|----------------------|--|--------|
| —Slow Moving Traffic | <p>A pull out area is an additional right lane about 2000 feet long added to the roadway for slower moving vehicles</p> <ul style="list-style-type: none"> • Slower moving vehicles can move into the pull-out area, and continue moving down the road, allowing faster moving traffic the opportunity to pass safely • In Montana, if more than four vehicles are being held up by a slow moving vehicle, the law requires pulling over and letting faster moving traffic go ahead | T10-24 |
| ◆ Effect of Altitude | Altitude can have an effect on drivers and vehicles | |
| —On Drivers | <p><u>Effect on drivers</u></p> <p>Drivers can encounter problems at high altitudes because of lower amounts of oxygen</p> <ul style="list-style-type: none"> • Symptoms include increased heart rate, shortness of breath, headaches, reduced concentration, drowsiness <ul style="list-style-type: none"> ... If any of these symptoms are experienced pull over and rest, change drivers or select a route with lower elevations ... If the driver is already tired, these symptoms are usually increased | T10-25 |
| —On Vehicles | <p><u>Effect on vehicles</u></p> <p>Higher elevations can reduce a vehicle's available horsepower—the car may not perform as well at 10,000 feet as it does at sea level</p> <p>Thinner mountain air can effect vehicle performance by:</p> <ul style="list-style-type: none"> • Overheating easier • Stall easier • Sluggish acceleration • Reduced pulling power for uphill driving <p>While driving in the mountains, check gauges regularly</p> <ul style="list-style-type: none"> • If the vehicle starts to overheat, turn off the air conditioner then turn on the heater to pull some of the heat from the engine <p>Find a safe place to pull over and stop</p> <ul style="list-style-type: none"> • Let the engine idle for a moment to see if it starts to cool off • Vapor lock may occur if the vehicle is turned off when very hot • The vehicle will not start again until it has cooled off <p>On steep upgrades watch the vehicle's temperature gauge, turn off the air conditioning if the temperature starts to climb</p> <ul style="list-style-type: none"> • If the engine needs cooling off, find a safe place to pull off the road, park and keep the car at a fast idle <ul style="list-style-type: none"> ... Do not shut off the engine, and never remove a hot radiator cap ... A faster way to cool an engine is to turn on the heater, but usually that option can make the occupants very warm | T10-26 |
| | | T10-27 |

Student Learning Activities

Resources



HILLS AND MOUNTAINS

When driving on mountain roads, be sure the brakes, windshield wipers, defroster, heater, and exhaust systems are all in good working order

Montana has several steep grades such as Homestake Pass in Butte — The grades range from 6-7 percent



M10-24

HILLS AND MOUNTAINS

Effect of Altitude on Drivers

- The lower amount of oxygen can:
 - Increase heart rate
 - Create shortness of breath
 - Cause headaches
 - Reduce concentration
 - Cause drowsiness
- When any of these symptoms are experienced, pull over and rest, change drivers, or select a route with a lower elevation
- Driver fatigue can increase these symptoms



M10-25

HILLS AND MOUNTAINS

Effect of Altitude on Vehicles

- Higher elevations can reduce available horsepower, causing the vehicle to not perform as well at 10,000 feet as it does at sea level

Thinner mountain air can affect a vehicle by:

- Making it easier to overheat
- Making it easier to stall
- Causing sluggish acceleration
- Reducing pulling power for uphill driving



M10-26

M 10

HILLS AND MOUNTAINS

Effect of Altitude on Vehicles (Cont.)

- Check gauges regularly
- Overheating? Turn off the air conditioner and turn on the heater to pull some of the heat from the engine
- If the engine needs cooling, find a safe place and pull off to the side and park, keeping the car at a fast idle
 - Do not shut off the engine and never remove a hot radiator cap
 - Let the engine idle to see if it will start cooling off
 - Vapor lock could occur if the vehicle is turned off when very hot; the engine will not start again until it has cooled off



M10-27

| Instructional Topic | Content | Slide |
|----------------------|---|--------|
| ◆ Approaching Uphill | <p>Introduce, model, practice and discuss</p> <ul style="list-style-type: none"> • See the hill at least 12-15 seconds ahead <ul style="list-style-type: none"> ... Decide the best speed and lane position ... Check rear zone for potential problems ... Passing lanes on uphill roads help facilitate the movement of traffic | |
| —Searching | <ul style="list-style-type: none"> • Aggressively search for clues that could affect speed or lane position <ul style="list-style-type: none"> ... Check for warning sign showing an advisory speed ... Look for oncoming traffic ... Be aware of road conditions for traction control ... Identify slow moving vehicles and look for a passing lane • Hills may include many curves <ul style="list-style-type: none"> ... Curves could be sharp and include switchbacks where the road switches direction ... There can be multiple switchbacks when driving through very hilly or mountain terrain <p>If the line of sight is restricted by the hill, approach in LP1 to get the most separation from oncoming traffic</p> <ul style="list-style-type: none"> • When meeting oncoming traffic on narrow or one-lane roads the traffic coming downhill must yield the right of way to the uphill traffic | T10-28 |
| —Speed Control | <ul style="list-style-type: none"> • Gravity will slow the vehicle as it travels uphill <ul style="list-style-type: none"> ... When traveling uphill, speed will be lost if extra power is not used ... To maintain speed to overcome gravity's pull, accelerate more ... If safe, accelerate at the bottom of the hill rather than losing momentum going up the hill, then trying to gain the speed back again | T10-29 |
| —Lane Use | <p>Slower moving vehicles need to be in the right-hand lane</p> <ul style="list-style-type: none"> • Montana law requires slower moving vehicles delaying four or more vehicles in a rural area or on a two-lane highway to turn off the road in a safe location to let the other vehicles pass | T10-30 |
| —Passing Lane | <p>Many heavily traveled hills have an additional middle lane that allows faster moving vehicles going uphill to pass slower vehicles on the right</p> <ul style="list-style-type: none"> • Some passing lanes are restricted for use by the uphill driver • Some passing lanes may be open to both uphill and downhill users | T10-31 |

Student Learning Activities

Resources



HILLS AND MOUNTAINS

Approaching Uphill — Searching

- **Search** 12-15 seconds ahead for advisory speed signs, oncoming traffic, road conditions for traction control, and slow moving vehicles
- **Identify** if the hill has curves and determine the type of curve for decision-making about speed and lane positions



- If there is a LOS, use LP1
- On narrow or one-lane roads, downhill yields to uphill traffic

M10-28

HILLS AND MOUNTAINS

Approaching Uphill — Speed Control

- Extra power may be needed to maintain uphill speed
 - Start acceleration at the bottom of the hill to maintain momentum
- Slower moving vehicles travel in the right-hand lane



M10-29

M 10

HILLS AND MOUNTAINS

Approaching Uphill — Passing Lane

- Some hills and mountains provide a center lane for passing for faster moving vehicles going up hill
 - Some passing lanes are restricted for use by the uphill driver
 - Some passing lanes may be marked for both uphill and downhill users



Two lanes going up hill provide for a passing lane for faster-moving vehicles

M10-30

HILLS AND MOUNTAINS

Cresting the Hill

- When possible, look over the hillcrest for an open POT
- Stay in LP1 at the crest
- Be prepared to move to LP3 if there is a POT restriction or hazard



What potential hazards could exist on the other side of the hill crest?

M10-31

| Instructional Topic | Content | Slide |
|-----------------------|--|--------|
| ◆ Cresting the Hill | As soon as possible look over the hillcrest for an open POT | |
| —Lane Position | <ul style="list-style-type: none"> Stay in lane LP1 as the vehicle reaches the top of the hill (crest) ... Be prepared to move to LP3 if there is a POT restriction or hazard ... Expect the unexpected to reduce surprises | |
| ◆ Descending the Hill | When driving downhill, gravity will pull at the vehicle, causing it to go faster | T10-32 |
| —Speed Control | <ul style="list-style-type: none"> Speed control is essential, especially on steep grades <ul style="list-style-type: none"> ... Downshifting helps maintain vehicle control by using the vehicle's transmission to keep the vehicle from accelerating out of control ... Downshifting will help prevent the brakes from overheating and possible break failure ... Do NOT ride the brakes while driving down a grade ... Constant braking can cause the brakes to heat and eventually fade—it's a sign a lower gear is needed ... If you are using your brakes excessively, downshift Braking distances will increase when going downhill <ul style="list-style-type: none"> ... Test the brakes before going downhill to be sure they are working Consider the total weight of the vehicle, including cargo <ul style="list-style-type: none"> ... Heavier vehicles will pick up more momentum as speed increases Control speed by reducing speed early It is wise not to use cruise control when driving downhill Brakes out of adjustment will not brake as efficiently Check the rear zone for vehicles and large trucks that may be having trouble controlling downhill speed Coasting down hills is illegal and dangerous because gravity will make the vehicle go faster MCA 61-8-362 On very long, steep grades (6 degrees or greater), gravity will cause the vehicle to increase speed even without any acceleration | T10-33 |

Student Learning Activities

Resources



HILLS AND MOUNTAINS

Descending the Hill — Speed Control

- Speed control is essential to overcome gravity that will make the vehicle go faster
 - Downshift and use the transmission to reduce speed and help keep brakes from overheating
 - Avoid riding the brakes
 - Montana Law: coasting downhill is illegal



What are the clues in this scene that describe the roadway conditions?

M10-32

HILLS AND MOUNTAINS

Descending the Hill — Speed Control (Cont.)

- Heavier vehicles will pick up more momentum as speed increases
- Turn off the cruise control
- Brakes out of adjustment will not brake as efficiently
- Check the rear zone for vehicles that may be having trouble controlling speed



Did the pickup truck driver make a legal, safe passing maneuver?

M10-33

M 10

| Instructional Topic | Content | Slide |
|--------------------------------------|---|--------|
| <p>◆ Descending the Hill (Cont.)</p> | <p>Watch for a rapidly approaching large vehicle (particularly one with white smoke boiling out from beneath the vehicle—it could be a run-away because the driver has lost braking capability)</p> <ul style="list-style-type: none"> • Montana has several steep grades, e.g., Homestake Pass in Butte ... The grades range from 6 to 7 percent | T10-34 |
| <p>—Runaway Ramps</p> | <p>Runaway ramps are designed primarily for large trucks (tractor-trailers) that lose braking control on steep downhill grades Run-off ramps can also be on short steep hills in areas of dense traffic</p> <ul style="list-style-type: none"> • When run-off ramps are located at the bottom of the hill it may be due to fatal crashes in the area • Use is restricted to runaway vehicles • Runaway vehicles may be escorted by law enforcement operating their emergency lights to warn others to move out of the way • Never attempt to outrun a runaway vehicle • Pull off the road as far as possible to give the driver the maximum amount of room • These areas are maintained for runaway vehicles <ul style="list-style-type: none"> ... These sections of the roadway contain deep gravel, sand barrels, and other materials to help slow down vehicles ... When they are in areas where it freezes, chemicals are added to keep the runaway ramp from freezing • As soon as the new target area is seen, evaluate the LOS-POT for the best lane position | |
| <p>◆ Starting on Hills</p> | <p>Some hills are so steep it requires use of the accelerator and brake together to maintain control of the vehicle</p> | T10-35 |
| <p>—Uphill With Automatic</p> | <p>When starting uphill with an automatic, be prepared to keep the vehicle from rolling backward by ensuring the parking brake is fully engaged</p> <ul style="list-style-type: none"> ... Before moving, check for open zones to the front, sides, and rear ... Maintain brake pressure until ready to move forward ... On steep hills, use the parking brake for moving forward ... Use the right foot to accelerate, while simultaneously, and slowly, releasing the parking brake | |
| <p>—Uphill With Manual</p> | <p>With a manual transmission, ease off the clutch to the friction point while slowly and fully releasing the parking brake</p> <ul style="list-style-type: none"> • Use controlled acceleration <ul style="list-style-type: none"> ... Before moving, check for open zones to the front, sides, and rear ... Maintain brake pressure until ready to move forward ... Ease off the brake and maintain space to the front zone; accelerate smoothly | T10-36 |

Student Learning Activities

Resources



HILLS AND MOUNTAINS

Descending the Hill — Runaway Ramps

- Runaway ramps are designed and restricted to large trucks that lose braking control on steep hills
- These sections have deep gravel, sand barrels and other materials to help slow down the runaway
- Pull off the road; give the runaway maximum room



M10-04

M 10



Starting on Hills — Automatic Transmission

- Some steep hills require using the accelerator and brake together to keep the vehicle from rolling back
- Before starting, check that the parking brake is on
- Maintain brake pressure until ready to move
- Use the right foot to accelerate and simultaneously slowly release the parking brake



M10-05

Photo courtesy of Washington State DOT



Starting on Hills — Manual Transmission

- Maintain brake pressure until ready to move
- Ease off the clutch to the friction point while slowly and fully releasing the parking brake
- Ease off the brake and accelerate smoothly with controlled acceleration



M10-06

Photo courtesy of Washington State DOT

| Instructional Topic | Content | Slide |
|-------------------------|--|--------|
| ◆ Stopping on Hills | <p>Sometimes it is necessary to brake to a stop on a hill</p> <ul style="list-style-type: none"> Stopping on a hill will require extra brake pressure to keep the vehicle from rolling down hill | |
| —Automatic Transmission | <ul style="list-style-type: none"> With an automatic transmission <ul style="list-style-type: none"> ... Squeeze the brake until stopped ... Keep the foot on the brake while stopped ... If turning off the vehicle ignition, but not parking, set the parking brake | T10-37 |
| —Manual Transmission | <ul style="list-style-type: none"> Drivers want to avoid excessive wear on the clutch <ul style="list-style-type: none"> ... Use the left foot to disengage the clutch ... Use the right foot to brake to a stop ... If turning off the engine, set the parking brake, and shift to First or Reverse Remember, drivers need to exercise caution by not rolling back into traffic stopped behind them | T10-38 |
| ASSIGNMENT | | |
| ASSESSMENT | | |

Student Learning Activities

Resources



HILLS AND MOUNTAINS

Stopping Uphill — Manual Transmission

- Use left foot to disengage the clutch
- Use the right foot to brake to a stop
- When turning off the engine, set the parking brake and shift to 1st gear or reverse



M10-27

HILLS AND MOUNTAINS

Stopping Uphill — Automatic Transmission

- Squeeze the brake until stopped
- Keep the foot on the brake while stopped
- When turning off the engine, set the parking brake



M10-28

M 10